Electromagnetic Exposure — A Secret Agenda? —

If proposed revised EMR safety standards are adopted, Australians and New Zealanders may soon legally be exposed to five times today's radiation levels, despite damning evidence that no level is actually 'safe' for health.

by Don Maisch

Extracted from his report
Non-Ionizing Electromagnetic Fields and Human Health: Are Current Standards "Safe"?
First published October 1994
Updated March 1995
Compiled for the Australian Democrats

3rd May 1995

Dear Editor,

I've been meaning to contact your magazine for several months now regarding the health hazards from microwave/radiofrequency (MW/RF) electromagnetic radiation (EMR).

My report deals with power-line frequencies (ELF), and covers some of the problems with RF/MW frequencies. Of special concern are current attempts by the Standards Association of Australia to increase existing maximum exposure limits for RF/MW radiation by a factor of five (times five).

The Standards Sub-committee met last week for a vote on whether to pass the proposals or not. The CSIRO [Commonwealth Scientific & Industrial Research Organisation]—a committee member and a strong opponent of increasing existing radiofrequency exposure levels—delivered a damning report which indicated that the existence of athermal (low-level) biological effects must be taken into account in setting exposure levels, and that the proposed DR95900 levels are dangerously high.

As a result of the CSIRO report and their scientific opposition to DR95900, Telecom and Optus (much to their credit) withdrew their support for the DR95900's increased limits and abstained from the final vote. They apparently stated, in light of the CSIRO report, that they saw no need to increase existing levels.

However, the Department of Defence representatives on the Standards Committee voted in favour of increasing RF/MW exposure levels, so that when it came to the vote, of the 20 committee members, seven voted against and nine for, with four abstentions.

Dr Michael Rapicholi, committee chairman and architect of DR95900, considered a vote of nine out of 20 as approval, and succeeded in ramming the new standards through against much opposition. The relevant trade union representatives on the committee have indicated that they will actively oppose the adoption of DR95900 by the Australian and New Zealand governments.

In my conversations with several people involved with this particular committee, concerns were raised about a possible "secret agenda" in the insistent push to get these high limits approved by the committee.

After all, if Telecom and Optus see no need to increase existing limits, then why do "we" need significantly higher levels?—especially so, considering the significant hazards as mentioned by the CSIRO and in several other submissions to the committee.

It is possible that the push to raising safety limits is more to do with the development of future MW/RF technology than with existing communication systems. Our exposure to MW/RF radiation is increasing rapidly with the development and popularity of cellular/mobile phones, wireless communications, etc.

One such "brave new world" project which is of concern is a plan to surround the world with an array of low-orbit satellites which would be part of a global cellular phone system. With this system, mobile phone users can call anywhere in the world. Instead of the phone transmitting to a nearby phone tower, it would transmit directly to an overhead satellite positioned about 500 kilometres high.

Obviously such a phone would require more transmitting power than existing ones. So are present mobile phones "safe"? The following information may be of interest to mobile phone users and prospective buyers:

1. Studies have shown that 30 per cent of the radiated energy from the aerial of a mobile phone is absorbed directly into the brain of the user.
2. Two research studies on EMR at frequencies similar to mobile phone transmissions have shown it to cause DNA breakages in the brains of exposed rats.
3. The US Food and Drug Administration has advised mobile phone users to use them only when absolutely necessary and, when used, to make calls as brief as possible.
4. Recent legal claims in the USA maintain that brain tumours may be caused by the use of digital cellular telephones.

I am currently collecting information for a report dealing exclusively with cellular (mobile) telephone systems and the health hazards implicated.

Looking forward to hearing from you,

Yours sincerely,

Don Maisch
North Hobart, Tasmania, Australia

[From the updated March 1995 report, "NON-IONIZING ELECTROMAGNETIC FIELDS AND HUMAN HEALTH: ARE CURRENT STANDARDS "SAFE"?" compiled by Don Maisch.]

7.0 THE OTHER SIDE OF THE COIN: WHAT THE "EXPERTS" SAY

In drafting its own guidelines for both residential and occupational exposure to ELF (50 Hertz) electromagnetic radiation, Australian regulatory authorities have taken their guidelines and standards from overseas expert groups, which are covered in this section. Current Australian exposure limits for ELF electromagnetic radiation are the same as the IRPA/INIRC limits (Section 7.3). For residential magnetic field exposures this is 1,000 milligauss; and occupational, 5,000 milligauss.

When questions are raised by concerned citizens or groups about EMF health hazards, Australian authorities such as the NH&MRC [National Health & Medical Research Council] and the ARL [Australian Radiation Laboratory] invariably refer to these expert groups as the ultimate authority on the issue. In fact, Australian regulatory authorities apparently have uncritically accepted the conclusions and standards set up by these expert groups as "gospel"—not to be questioned.

It is certainly a necessity for any government policy decision-maker to seek expert advice on a wide range of issues. However, when it comes to the EMF/health hazard issue, the impartiality of these so-called expert groups is very much in doubt.

To put it bluntly, from my study of statements and decisions made by these expert groups, referred to in this paper, they seem to be 'factoring in' other concerns, such as political, economic and military vested interests, in their conclusions. This bias on the side of these expert groups has done much to cloud the fact that the evidence for significant biological effects from low-level electromagnetic fields is very strong.

This bias on the side of these expert groups has done much to cloud the fact that the evidence for significant biological effects from low-level electromagnetic fields is very strong.

In the following discussion of some of the major expert groups, the same problem arises in reference to standards covering the radiofrequency part of the electromagnetic spectrum—that is, they do not take into consideration low-level, non-thermal biological effects.

7.1 GREAT BRITAIN (NRPB)

In 1989 the British National Radiological Protection Board (NRPB), which has the responsibility for advising the government on the possible adverse health effects of both ionizing and non-ionizing radiation, released guidelines GS-11. These stated that the guidelines were for electric shock and heating effects only, and did not attempt to address low field-level (non-thermal) effects.

The NRPB stated that it did not consider there was sufficient evidence of such low field-level effects to include in their guidelines.[96]

In May 1992, the NRPB issued a progress report on their evaluation of the biological effects of low-frequency electromagnetic fields.

The NRPB said of the experimental studies so far:

"The available evidence weighs against electromagnetic fields acting directly to damage cellular DNA implying that these fields may not be capable of initiating cancer..."[97]

Official British Planning Policy Guidance on the development of telecommunications transmitting facilities is the PPG8. This document basically gives the go-ahead for most installations, stating that government policy is to facilitate the growth of the telecommunications industry, including cellular phones. Many commercial companies have been granted licences without the need even to apply for planning permission. Where they do need to apply, the PPG8 specifically states that "Radiation is a matter for the Health and Safety Executive (HSE) and not a matter for the planning system".[98]

Considering that official British Government planning policy is to encourage the growth of the telecommunications industry, the NRPB's role as an impartial regulator in setting EM exposure limits is drawn into doubt, especially as they still refuse to consider low-field biological effects in setting their guidelines/standards.

An example of the NRPB's apparent bias in favour of the telecommunications industry at the expense of "safe" standards can be found in the March 1994 NRPB bulletin. Dr Kenneth Duncan, the NRPB's medical adviser, in an editorial discussing the policy of Prudent Avoidance (which the British Government has rejected), stated:

"Prudent Avoidance may seem as an intellectually indolent term to avoid proper assessment of risk and benefits and to escape the opposition that positive decision-making sometimes provokes... If we are to come to sensible conclusions in times of scientific and technical advance, we must be prepared to have an underlying philosophy which accepts that some risks have to be accepted... some of these judgements may be unpopular but should not be avoided."[99] *[Author's emphasis added.]*

7.2 THE USA (ORAU)

In 1989, the Oak Ridge Associated Universities (ORAU) was commissioned by the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) to establish a panel to conduct an "independent" scientific review, and evaluation of the reported health hazards of exposure to extra low frequency electromagnetic fields, especially those related to cancer and to reproductive and neurophysiological effects.

In 1992 this panel concluded that:

"This review indicates that there is no convincing evidence in the published literature to support the contention that exposures to extremely low-frequency electric and magnetic fields (ELF/EMF) generated by sources such as household appliances, video display terminals, and local power-lines are demonstrable health hazards. Epidemiological findings of an association between electric and magnetic fields and childhood leukemia or other childhood or adult cancers are inconsistent and inconclusive. No plausible biological mechanism is presented that would explain causality. Neither is there conclusive evidence that these fields initiate cancer, promote cancer, or influence tumor progression. Likewise, there is no convincing evidence to support suggestions that electric and magnetic fields result in birth defects or other reproductive problems. Furthermore, any neuro-behavioral effects are like-

ly to be temporary and do not appear to have health consequences."

The ORAU panel, not content to let the issue die there, 'nailed the final nail into the coffin' with the following ending:

"This review does not provide justification for a major expansion of the national research effort to investigate the health effects of ELF/EMF. In the broad scope of research, any health concerns over exposures to ELF/EMF should not receive a high priority."[100]

The independence of the ORAU panel is severely compromised by the fact that J. Glenn Davis, Chairman of the Medical Sciences Division of ORAU, and who headed the panel, was previously a senior US Air Force commander who retired from active duty in 1990 to take up his position at ORAU. The US Air Force has played an active role in opposing EMF research. (See Section 1.5 The 1990 EPA Report, and Section 7.6, page 33, reference 110).

Another possible military connection with the ORAU panel was the fact that they excluded the scientific literature and standards relative to all higher frequencies in the electromagnetic spectrum above 30 KHz, thereby excluding radio, microwave and radar frequencies which the military is obviously heavily reliant on.

7.3 IRPA/INIRC INTERIM GUIDELINES 1990

The International Radiation Protection Association and its committee, the International Non-Ionizing Radiation Committee (IRPA/INIRC) had the responsibility for the development of health criteria standards for non-ionizing radiation. Their standards form part of the World Health Organisation's Environmental Health Criteria Programme and has been adopted by the Australian Radiation Laboratory and the National Health & Medical Research Council as the standards for Australia.

To quote from their guidelines:

"From a preview of the scientific literature, it is apparent that gaps exist in our knowledge, and more data needs to be collected to answer unresolved questions concerning biological effects of exposure to these fields (EMF). On the other hand, analysis of the existing literature does not provide evidence that exposure at present day levels has a public health impact which would require corrective action.

"A cost-benefit analysis taking into account national public health priorities and consideration of economic impact and social issues may be necessary to derive limits suited to the conditions prevailing in different countries." *[Auth. emph.]*

The exposure limits for magnetic fields are as follows:

Limits of Exposure to 50/60 Hertz magnetic fields

I. Occupational—Magnetic Field Intensity	
Whole working day	5,000 milligauss
Two-hours-per-day limit	50,000 milligauss
For limbs	250,000 milligauss
II. General Public (Residential)—Magnetic Field Intensity	
24 hours per day	1,000 milligauss
Two-hours-per-day limit	10,000 milligauss

When you consider that the magnetic field levels indicated as having adverse health effects in the studies listed earlier are in the range of 1 to 4 milligauss, there is cause for concern, to say the least.

Why this discrepancy? It is hard to believe, but all the studies indicating adverse health effects were apparently not considered by the IRPA/INIRC when setting the standards. They admit this in their concluding remarks:

"The exposure limits are based on established or predicted effects of exposure to 50/60 Hz fields. Although some epidemiological studies suggest an association between exposure to 50/60 Hz fields and cancer, others do not.

"Not only is this association not proven, but present data does not provide any basis for heath risk assessment useful for the development of exposure limits." *[Auth. emph.]*

Further on in the IRPA/INIRC interim guidelines, they state: "To date, chronic low-level exposure to 50/60Hz fields has not been established to increase the risk of cancer".[101]

...they excluded the scientific literature and standards relative to all higher frequencies in the electromagnetic spectrum above 30 KHz, thereby excluding radio, microwave and radar frequencies which the military is obviously heavily reliant on.

7.4 THE INTERNATIONAL COMMISSION ON NON-IONIZING RADIATION PROTECTION (ICNIRP)

The ICNIRP took over from the previous IRPA/INIRC committee as standard-setter for non-ionizing radiation. To quote from their press release of 12 May 1993:

"The International Commission on Non-Ionizing Radiation Protection (ICNIRP) reviewed the data about possible carcinogenicity of power-frequency magnetic fields at its first annual meeting on May 7-12, 1993, held in Neuherberg, Germany. This review considered all scientific data that have been published or publicly presented since the "Interim Guidelines on Limits of Exposure to 50/60 Hz Electric and Magnetic Fields" were published in 1990 by the predecessor International Non-Ionizing Radiation Committee (INIRC) of the International Radiation Protection Association (IRPA). The major reason for the interim nature of these guidelines was the inability to arrive at a scientifically-based judgement concerning any causal relationship between 50/60 Hz magnetic field exposures and the excess occurrence of cancer.

"The most recent data reflect some improvements in methodology in laboratory studies and in epidemiological studies of both occupational and general populations. After careful consideration of this evidence, the Commission concludes that the data related to cancer do not provide a basis for health-risk assessment of human exposure to power-frequency fields. Accordingly, the Commission confirms the interim guidelines published in 1990 (IRPA/INIRC 1990)."[102] *[Auth. emph.]*

7.5 THE AUSTRALIAN RADIATION ADVISORY COMMITTEE—AND THE THERIAULT STUDY

In September 1994, in the Annual Report of the Radiation Advisory Committee, the RAC gave their version of the outcome of the French/Canadian study of electrical workers, known as the Thériault study. To quote from their report:

"A combined French/Canadian occupational study was published this year. The study looked at whether workers in three electricity utilities with exposure to higher levels of magnetic fields had a higher incidence of cancer in the study period 1970-1989. The study provided no conclusive evidence of a link between occupational exposure to power-frequency magnetic fields and cancer, and there was little or no consistency between the three utilities studied."[103] *[Auth. emph.]*

Of the thousands of research papers on EMF health effects dating back to the 1970s, none has found conclusive evidence.

Conclusive evidence in relation to health issues only comes about by comparing a large number of individual studies to build up a case, such as was done with tobacco smoking. Sir Richard Doll (NRPB) himself admitted this about the smoking issue. It is very unscientific to use this term in relation to only one study.

As for the Thériault study, its results are similar to findings from previous studies. That is, positive associations between ELF magnetic field exposure and a number of cancer types were indicated, with associations being strongest for leukaemias, followed by brain cancers.[104]

In a further analysis of the Thériault study by Dr Gilles Thériault and his team at McGill University, high-frequency transients (HFTs) and worker exposure were studied. Results showed up to a tenfold increased risk of developing lung cancer among highly exposed utility workers and a "very clear" exposure-response relationship.

This second analysis by Thériault has resulted in Hydro-Quebec (which owns the data collected by Thériault) barring Thériault and his team from further access to the data.[105] This is the kind of thing which can happen when vested interests, such as power companies, fund research.

To find an "expert" group such as the Radiation Advisory Committee giving such an inaccurate report on the Thériault study is cause for concern.

This inaccurate reporting is perhaps understandable considering (quoting from the Victorian Government's "Report of the Panel on Electromagnetic Fields and Health", September 1992):

"To date, the responsibility for communicating with the community about ELF fields has rarely been clearly defined, and most information is developed and disseminated by the utilities, as health authorities have not considered ELF fields as an important health matter."[106] *[Auth. emph.]*

It is inadvisable just to depend upon the electric power suppliers to pass on information to the public or health authorities, for results can be altered to suit their vested interests.

To get to the real issues involved in the EMF/health hazards debate, it is necessary to look past the "expert" groups and study the large body of scientific literature on the subject. This is a very complicated area which is made more complicated by the fact that the present situation on environmental electromagnetic fields involves highly polarised opinions.

It is inadvisable just to depend upon the electric power suppliers to pass on information to the public or health authorities, for results can be altered to suit their vested interests.

8.0 CONCLUSION

Current Australian regulations on human exposure to electromagnetic radiation are based on the ICNIRP/INIRC guidelines mentioned above, which, in part, state: "analysis of the existing literature does not provide evidence that exposure at present-day levels has a public health impact which would require corrective action". *[Auth. emph.]*

However, considering the studies and weight of the evidence of human health hazards, the consistency of these reports and the seriousness of the diseases implicated, it is now unacceptable for Australian Government agencies responsible for advising and setting standards to continue to base their recommendations on outdated guidelines which are no longer appropriate in light of the evidence.

In contrast, the European Parliament has taken a strong progressive stand on limiting EMF exposure by adopting a resolution, titled "On Combating the Harmful Effects of Non-Ionizing Radiation".

This resolution recognises that "the difficulty of demonstrating a relationship between dose and effect, enabling the effect of non-ionizing EMFs to be quantified...does not prevent the adoption of legislative measures designed to minimise the exposure of workers and the public".

The European Parliament resolution takes seriously the health hazards from electromagnetic radiation. To quote in part from the resolution:

"...according to an increasing number of epidemiological and experimental studies, even slight exposure to non-ionizing electromagnetic fields increases the risks of cancer, can be accompanied by nervous disorders and disruption of the circadian rhythms and seems capable of affecting developing organisms...

"...the results of many *in vivo* and *in vitro* studies show increasingly clearly that the interaction mechanisms underlying such disorders and illnesses, centred mainly in the cell membrane, lead to disruption of melatonin secretions, ornithine decarboxylase activity and T-lymphocyte efficacy, testifying to the probable role of non-ionizing radiation in promoting cancer...

"...synergy phenomena must be expected between non-ionizing radiation and other physical or chemical agents."[111]

Footnotes:

96. *Electromagnetics and VDU News*, July/Dec 1993.
97. "Are Powerlines Bad for You?", *New Scientist*, 11 April 1992, pp. 22-23.
98. *Electromagnetics and VDU News*, July/Dec 1993.
99. *Radiological Protection Bulletin*, NRPB, March 1994.
100. "Health Effects of Low-Frequency Electric and Magnetic Fields", *Environmental Sciences Technology*, vol. 27, no. 1, 1993, pp. 42-51.
101. *Health Physics*, vol. 58, no. 1, January 1990, pp. 113-122.
102. ICNIRP Press Release, 12 May 1993.
103. "Annual Report of the Radiation Advisory Committee", Radiation Safety Section, Department of Health and Community Services, Australia, September 1994.
104. MacMillan, Ian, "Interpreting Thériault: An Independent Assessment of the Canadian-French EMF Cancer Study", June 1994.
105. *Microwave News*, November/December 1994.
106. "Report of the Panel on Electromagnetic Fields and Health" to the Victorian Government, September 1992.
107. *Microwave News*, January/February 1994.
108. *Microwave News*, September/October 1994.
109. *Microwave News*, May/June 1994.
110. *Microwave News*, September/October 1992.
111. *Microwave News*, July/August 1994, pp. 13-15.

For further information on power-line issues, field measurements, strategies, etc., contact:

Australia: • **Powerline Action (Vic.) Inc./EMF Advice**—Ian MacMillan, 3/247 Flinders Lane, Melbourne, Vic. 3000; phone (03) 654 4512, fax (03) 650 3689. • **Association of Citizens Against Telecommunication Towers (ACATT)**—Kate Barrett, 2/91 Henley Beach Rd, Henley Beach South, SA 5022; phone (08) 356 4408.

New Zealand: • **Adopt Radiation Controls, Inc. (ARC)**—c/- Bruce Morrison, PO Box 21113, Henderson, Auckland. • **Environmental Protection for Children Trust (EPC)**—393 Ilam Road, Christchurch; phone +64 3 351 7329, fax +64 3 343 3693.

Canada: • **PACE Canada**—100 Bronson Ave, #1001, Ottawa, Ontario KIR 6GH; phone +1 (613) 236 6265, fax +1 (613) 235 5976.

Sweden: • **FEB (Association for the Electrically and VDT Injured)**—Box 115126, 104 65 Stockholm; ph+46 (8) 712 9065, fax +46 (31) 83 3509.

UK: • **London Hazards Centre**—Interchange Studios, Dalby Street, London, NW5 3NQ. • **PowerWatch UK**—c/- 2 Tower Road, Sutton, Ely, Cambs, CB6 2QA.

USA: • **National EMR Alliance**—410 West 53rd St, #402, New York, NY 10019; phone +1 (212) 554 4073, fax +1 (212) 977 5541.

Non-Ionizing Electromagnetic Fields and Human Health: Are Current Standards "Safe"? (ISBN 0-646-224050)
This Report, written and compiled by Don Maisch, is available from the author at PO Box 96, North Hobart, Tasmania 7002, Australia.
Price: AUD$10.00 inc. p&h in Aust; AUD$11.50 airmail to NZ; AUD$14.00 airmail to Canada/Europe/UK/USA.

Draft Standard 95900: Maximum Exposure Levels 3 KHz to 300 GHz

7.6 AUSTRALIA/NEW ZEALAND DRAFT STANDARD 95900—MAXIMUM EXPOSURE LEVELS 3 KHz TO 300 GHz

(This draft standard, a proposed revision of an earlier standard (AS/NZS 2772.1), deals with exposure levels in the radiofrequency/microwave part of the electromagnetic spectrum. This draft was issued for comment on 1st February 1995 and closed on 15th March 1995.

The following is taken from a letter sent to Standards Australia by Senator Robert Bell of Tasmania and this writer.)

Mr McAlpine
Standards Australia
PO Box 1055
Strathfield NSW 2135

14th March 1995

Dear Mr McAlpine

I am writing to you to express several concerns about the implications of the "DR95900 Radiofrequency Radiation, Part I: Maximum Exposure Levels 3 KHz to 300 GHz".

If these proposals are accepted by the Australian and New Zealand governments, the general and working populations can legally be exposed to five times the current levels of radiofrequency radiation in the communications frequency. This includes microwave transmissions from telecommunication towers, cellular phones and their transmitters and radar transmitters.

These new limits, if accepted, will inevitably lead to significant increases in transmitting power levels by all users of the radiofrequency spectrum. It is these same users (vested interests) who are overwhelmingly represented on this drafts committee.

There has been almost no input from community groups and EMR scientists or medical experts not associated with these vested interests.

The reasoning or 'basic philosophy' used by the committee to come up with this fivefold increase is also of concern.

If I may draw your attention to paragraph 4 in the preface of this draft (page 2), to quote in part:

"that when only the established scientific literature is used, exposure limits can only be based on thermal effects in the frequency range about l0 MHz to 300 GHz. The scientific literature shows that, while non-thermal exposures may cause very minor perturbations to biological systems (isolated cells or tissues, but not in humans), there has not been found any adverse health impact from these exposure levels after almost 40 years of research." *[Auth. emph.]*

As stated in the preface, the DR95900 is based on the IRPA Guidelines and the USA IEEE C95.1-1991 Standard. In fact, the DR95900 and IEEE C95.1 are essentially setting the same limits, based only on thermal effects.

In November 1993, the US Environmental Protection Agency (EPA) came out strongly against the US Federal Communications Commission's proposal to adopt the IEEE C9S.1 standard on RF/MW exposure, contending that the standard has "serious flaws". The EPA questioned whether it is "sufficiently protective of public health and safety". The EPA criticised in particular the standard's different limits for controlled and uncontrolled environments and the failure to consider non-thermal effects.[107]

In 1993, the Phillips Laboratory at Kirtland Air Force Base in New Mexico came out strongly for the existence of non-thermal RF/MW health risks.

Dr Cletus Kanavy, a bio-effects researcher at the Phillips Lab, authored a White Paper on the biological effects of RF/MW radiation in which he concluded that "a comprehensive search of the worldwide literature" found that "a large amount of data exists...to support the existence of chronic non-thermal effects".

Dr Kanavy also noted in the White Paper that "The literature published in the late 1980s is abundant with information on non-thermal effects which are produced at levels below the ANSI standards." In the ANSI/IEEE C95.1 standard, he added, "The existence of non-thermal effects is essentially denied by omission".[108] *[Auth. emph.]* A copy of the White Paper is attached to this letter.

The US National Institute for Occupational Safety and Health (NIOSH) has also raised objections to the ANSI/IEEE C95.1 guidelines for basing exposure levels solely on thermal effects.[109] *[Auth. emph.]*

Dr Ross Adey, a leading researcher into EMR bio-effects, based at the VA Hospital in Loma Linda California, criticised the US Air Force for maintaining that EMR cannot cause non-thermal effects.

At a hearing before a US Senate Subcommittee in August 1992, Adey testified that "As a matter of policy, the Air Force denies existence of biological effects, attributable to athermal fields. Nevertheless, evidence for athermal bioeffects is incontrovertible for both low frequency and RF exposures".[110] *[Auth. emph.]*

The above criticisms of the US standards apply equally well to the DR95900, which is largely based on the American IEEE C95.1 standard mentioned above and only considers thermal effects. In light of the facts, to continue on this path of avoidance and omission is just the opposite of a proper scientific approach. It is a bit like the flat-earth controversy back in Galileo's time.

Paragraph 4 in DR95900 totally discredits the document's scientific validity due to its refusal to take athermal bio-effects into consideration, and its apparent ignorance of a large body of research. As such it should be rejected by both the Australian and New Zealand governments.

10.0 "Biological Effects of Microwave Radiation: A White Paper"

The White Paper reproduced below was written by Dr Cletus Kanavy, chief of the Biological Effects Group of the Phillips Laboratory's Electromagnetic Effects Division at Kirtland Air Force Base, NM, in October 1992. The references at the end of Kanavy's paper are omitted here.

The biological effects of microwave radiation on living organisms have been the subject of extensive research for the past four decades. The most comprehensive programs were conducted by the Soviet and Eastern Bloc nations. The US has lagged behind badly in this area of research. Initially, the principal concern for human exposure to microwave radiation was that of thermal heating of the tissues. Permissive exposure limits were based on such criteria. Since the 1970s this limit has been progressively set at lower levels of average field power density for the classical six-minute time average period. These limits, which are published as the American National Standards Institute (ANSI) microwave standards, are actually derived by the Institute of Electrical and Electronics Engineers (IEEE). Under IEEE, a blue-ribbon panel of experts periodically reviews the research database and assesses the need to revise the standards. Until 1991, these standards did not consider the possible biological effects of "pulsed" microwaves. The 1991 standards do address the pulse condition (rather shabbily, I believe), place restrictions on the number of pulses per six-minute time period as a function of pulse width, and continue to use the continuous wave time averaging technique for thermal criteria. The existence of nonthermal effects is essentially denied by omission.

The US research community was aware of the Soviet findings of deleterious biological effects at exposures well below the ANSI standards. The Soviet findings were rejected for various reasons. The principal reason was that US attempts to duplicate the Soviet results were reportedly not successful. It was not until the mid-1980s that US researchers began to successfully duplicate Soviet experimental results and began a research program to expand upon and further test the Soviet nonthermal theories.

Since March 1991, we have been conducting a comprehensive search of worldwide literature on the results of experimentation regarding biological effects produced by microwave radiation. The results of this search have been consolidated into a computerized database which we have shared with the Armed Forces Medical Intelligence Center and the Central Intelligence Agency. We attempted to share the database with the Armstrong Laboratory. A list of the holdings in the database was presented to Dr Dave Erwin of Armstrong who proceeded to 'line-out' the publications of researchers he believed not to be credible. These were researchers who were reporting the positive existence of nonthermal effects.

The literature published in the late 1980s is abundant with information on nonthermal effects which are produced at levels below the ANSI standards. These are essentially chronic exposure effects at low levels of average field power densities. Researchers stress the chronic, nonthermal nature of these effects as opposed to acute exposure thermal effects. Ample experimental evidence exists from credible researchers from well-established and highly regarded institutions, both government and university, to justify a national research program into the full spectrum of biological effects of electromagnetic radiation.

The principal electromagnetic biological effects of greatest concern are behavioral aberrations, neural network perturbations, fetal (embryonic) tissue damage (inducing birth defect), cataractogenesis, altered blood chemistry, metabolic changes and suppression of the endocrine and immune systems. The verification of blood-brain barrier suppression should have a high priority. The passage of normal blood-borne toxins into the brain could explain some previously observed early behavioral aberrations, loss of physical endurance, and functional central nervous system and perceptual changes. A large amount of data exists, both animal experimental and human clinical evidence, to support the existence of chronic, nonthermal effects. The Soviet studies of humans under occupational conditions report marked functional changes, sometimes accompanied by histological and biochemical changes, under the chronic influence of microwaves at power densities ranging from fractions of microwatts to a few milliwatts per square centimeter. Research to date has concentrated on determining the psychological/physiological effects (changes) produced by electromagnetic fields of various power densities, carrier frequencies and modulation rates. These results are the macroscopic part of the issue. The microscopic part of the issue urgently needs to be addressed—namely the physical mechanisms behind the various observed biological effects. Various theories and interaction models exist to explain, in a limited way, some of these physical mechanisms for specific effects. None have yet been positively verified. This is believed to be a key issue which needs to be addressed as soon as possible...

Other areas of concern center on the uninvestigated human response to high-peak, low average power, moderate-to-high-pulse repetition frequency microwave fields. The relationships between these variables and specific human responses should be of prime importance to the directed energy weapon (DEW) development programs. The ability of certain modulation frequencies imposed on various carrier frequencies to affect (lock onto) circadian rhythms poses a formidable research problem. A principal question raised is the existence of "frequency windows" and resonances associated with certain physiological and psychological responses. The past several issues of *Bioelectromagnetics* have contained many articles by prominent US researchers which report nonthermal effects. New concerns are also forthcoming, i.e., bio-effects of ELF and electromagnetic fields in close proximity to high-voltage power lines and transformer banks. Thus the entire issue of human interaction with electromagnetic (RF & microwave) radiation is pushing forward as a major national population health concern.

(Reprinted from *Microwave News*, Sept/Oct 1993)